Chemical Reactions

Prentice Hall *Physical Science* – Chapter 7

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Chemical Equations

- *Reactants*: substances that undergo chemical changes
- *Products*: new substances formed by chemical changes
- *Chemical equation*: a representation of a chemical reaction in which reactants and products are expressed as formulas

Reactants ⟶ Products

Carbon + Oxygen ⟶ Carbon dioxide

$C + O_2 \longrightarrow CO_2$

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Conservation of Mass

- Lavoisier established the principle of the Law of Conservation of Mass
- States that *mass is neither created nor destroyed in a chemical reaction*
- Conservation of mass is shown in *balanced* chemical equations: the number of each type of atom in the products equals that in the reactants

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Conservation of Mass (Cont'd)

- Example: burning of hydrazine (rocket fuel)

$N_2H_4 + O_2 \longrightarrow N_2 + H_2O$

▪2 atoms N	▪2 atoms N
▪4 atoms H	▪2 atoms H
▪2 atoms O	▪1 atom O

- To balance a chemical equation
  1. Count # of each type of atom on each side
  2. Change 1 or more coefficients until equation is balanced
- The example above becomes:

$N_2H_4 + O_2 \longrightarrow N_2 + 2H_2O$

▪2 atoms N	▪2 atoms N
▪4 atoms H	▪4 atoms H
▪2 atoms O	▪2 atoms O

- NEVER change the subscripts in the chemical formula (Why?)

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Counting with Moles

- Describing reactions with atoms and molecules has limited use – they're too small!
- Chemists use a "counting unit" called the *mole* to measure the amount of a substance
- The Mole
  - Abbreviation: *mol*
  - *1 mol = 6.02 x 10^{23} particles*

Avogadro's number

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Molar Mass and Mole-Mass Conversions

- *Molar mass*: the mass of one mole of a substance (g)
- For an element, it is equal to the atomic mass in g instead of amu
- For a compound, it is equal to the sum of the atomic masses of the component atoms (in g)
- Once the molar mass is known, you can convert between moles and mass

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